

**Before the  
Federal Communications Commission  
Washington, D.C. 20554**

In the Matter of

Carrier Current Systems, including	)	
Broadband over Power Line Systems (BPL)	)	
	)	
Amendment of Part 15 regarding new requirements	)	ET Docket No. 04-37
and measurement guidelines for Access Broadband	)	
over Power Line Systems	)	
	)	

**REPLY COMMENTS OF GARY PEARCE, KN4AQ**

I have been a licensed Amateur Radio operator since 1965, and currently hold an Amateur Extra class license. I am the editor of the SouthEastern Repeater Association magazine, the *Repeater Journal*, and a contributing editor to *CQ VHF* magazine. I am not an engineer, but I do have extensive practical experience with voice, cw and digital modes on HF and VHF/UHF. I operate multiple modes on HF, VHF and UHF both from home and mobile.

In addition, **I have direct experience observing the Progress Energy Phase I and Phase II BPL trial areas.** I am part of a team of local Amateur Radio operators that was invited by Progress Energy to observe their Phase II trial system.

As I read the comments of many of the utilities, vendors, industry groups and other proponents of BPL, I was struck by the reversal of expectations and responsibilities regarding interference created by these Part 15 devices. BPL operators take the position that they should be able to deploy their systems with a priority that has never existed, and is specifically denied by Part 15, and licensed primary services must complain, prove interference, then wait for the Part 15 operators to investigate.

In reality, BPL operators want to overlay a new radio service across the entire high-frequency radio spectrum. That fact that they do not wish it to radiate is beside the point. It does radiate, and they can't help it. It will be a low power, "unintentional" radiator, and as such they seek to justify it as unlicensed, under the cover of Part 15. But it has the potential to become ubiquitous service, with signals buzzing from power lines everywhere. No Part 15 device has had such pretensions. In the face of that reality, BPL's "low power" claim is a sham. It is capable of creating interference to primary service radio users far and wide. The restrictions placed on BPL's interference potential should be strong. Enforcement should be strong and quick. If that makes it difficult to operate a BPL system, that's too bad. If it does not, then they can proceed, and all will be well.

## **Progress Energy's definition of "harmful interference"**

As I stated in my original comments, the level of mitigation required — the usability of the HF radio spectrum — turns on the definition and interpretation of that phrase, as Part 15 devices are prohibited from causing harmful interference to licensed services. Progress Energy Carolinas (PEC) proposed a four part test, at least in part in response to complaints filed by me and other Amateur Radio operators over interference generated by their BPL trial south of Raleigh, North Carolina. Their proposal (in **bold type**), and my comments:

**1. The interference should have to occur in the normal course of the complainant's operations, rather than be the result of the complainant seeking out the interference.**

There are two ways to "seek out" interference: to tune across spectrum the operator might not normally use at their home station, and to drive around in a mobile station looking for any and all interfering signals.

In the first case, an operator who finds that BPL has been deployed in his or her neighborhood would be prudent to survey all the available spectrum and notify the utility if interference is found anywhere the operator may legitimately be expected to listen. Amateur Radio operators are licensed to operate at will on any and all frequencies assigned to the service. Shortwave listeners are protected by international treaty. Some radio users may use some parts of the spectrum more than other parts, but it's possible and likely that any radio user will follow propagation which dictates moving around the spectrum based on the time of day, the time of year, and year of the sunspot cycle.

So to the second case, the mobile operator driving around, and tuning around, looking for BPL interference to complain about. Is there a case to be made for doing this, or is this just an annoying tactic to cause the BPL operator grief?

Amateur Radio and shortwave listening are legitimate mobile activities. No additional burden is placed on mobile operation by the FCC rules – it can be done anytime, anywhere with the FCC's jurisdiction. On the other hand, BPL operators have repeatedly stated to the FCC and the press that their systems do not cause interference. They did not qualify the statements by saying "because there's no one there to hear it." Only after Amateur Radio operators and others proved them wrong did they amend the statement with a "yes, but..." They now admit that they radiate, and the radiation can cause interference. But they can fix it, and they even say it's easy. If they can fix it, they should "fix it" in advance. Complaints from radio users looking for problem areas will help them do this. The operators themselves have an interest in keeping all territory "interference free," as they may operate anywhere without advance warning. I'll discuss the time frame for "mitigation" later.

In any case, it will be difficult for the FCC to determine the radio operators intent when filing a complaint. A BPL operator can always claim that the radio operator was "seeking out" interference, putting an additional burden on the primary, licensed operator, and delaying their obligation to cure the problem..

**2. The interference should have to be more than momentary. That is, for example, if driving another 30 yards will virtually eliminate the interference, then it is not harmful.** There has long been some time frame element to Part 15 and harmful interference. Part 15 devices have been able to share spectrum with licensed services if their signals are infrequent and of short duration – for example, remote “keyless entry” devices to unlock car doors. BPL, however, can be 100% duty cycle – on all the time. Amperion’s system used by PEC fits that model. So again, the burden is to be placed on the licensed service to “get out of the way.”

Who is going to go out and prove that the mobile could move 30 yards and eliminate the interference? In some cases, a mobile can move perpendicular to a power line and the signal will be inaudible, although practice shows the distance to be more like 100 yards, not 30. But if the mobile is traveling along a road paralleled by the power line, the interference can last for a mile. That’s the case with the signal produced by the PEC trial along North Carolina route 55 near James Slaughter Road in the town of Fuquay-Varina. The signal is strong for at least a mile, and the power line paralleling the road isn’t even actively delivering BPL! It’s just radiating the signal generated a quarter mile away by an “injector” on James Slaughter Road.

It may be inconvenient for a BPL operator to accommodate a licensed, primary service mobile operator. But Part 15 is not designed for the convenience of the secondary service. The rules should not be twisted to that advantage.

**3. The interference should have to be proven to so greatly interfere with operations such that communications are practically unintelligible.** This is ridiculous on its face. No radio service is required to tolerate that level of interference from other *primary* users, much less from a Part 15 operator. Progress Energy operates a two-way UHF mobile radio system that its service crews depend on. Would they be willing to accept this level of interference on that radio system? The FCC would get a phone call immediately.

Setting a signal strength bar for interference to Amateur Radio and shortwave listening is difficult, and setting it high changes the nature of those services. Amateur Radio operators routinely tune across their bands, listening for any and all signals, and particularly listening for *weak* signals that may be coming from distant lands and low power stations.

There is plenty of interference to this operation already. Thunderstorms and other atmospherics, and a growing cacophony of man-made devices from doorbell buzzers to computer processors all make reception a challenge. Ironically, power lines present the greatest problem to the most stations already. Coronal discharge from worn and loose insulators and other problems on these high-voltage lines create broad band noise that can carry several blocks. Utilities have a mixed record in solving these problems. Some require prodding from the FCC before taking the trouble to track the noise down and fix it, and many Amateur Radio operators complain that they’ve waited months to have a problem cured... *if* it gets cured at all.

But at most Amateur Radio and shortwave listening stations today, most of the radio spectrum is

fairly noise-free. I hear my computer, and my neighbor's computer, here and there across the bands, but mostly I hear a quiet hiss on frequencies that have no intended signal (of course, on summer nights all bets are off on the frequencies below 10 MHz, where lightning propagates well). And under those conditions, Amateur Radio operators and SWLs roam the spectrum, looking for new and interesting signals. Often those signals are weak – just above that low noise floor, and the challenge is to understand the signal well enough to exchange information.

BPL in that spectrum, on a power line a few blocks away, changes that. The examples we've seen show that the signal occupies the entire band and more, and it's on the air continuously, 24/7. Not only does it make signals difficult or impossible to receive, it makes listening itself an unpleasant experience. Amperion's system puts carriers every 1.1 kHz across the entire band. In AM, the listener hears a continuous whine of 1 kHz heterodynes that blanket the band. In SSB or cw, the listener hears "beat notes" – a loud tone that varies as the receiver is tuned, but is always present because before the receiver tunes away from one carrier, it encounters the next one. In a speaker or headphones, this sound is highly irritating. Even a dedicated operator won't put up with it for long. The Main.net system puts a crackle across the spectrum, again occupying the entire band. It may sound more like natural noise (a bit like lightning static), but it's more persistent. And it's totally man-made – it's not supposed to be there.

Can the "harmful" threshold be set at "if I can hear it all day, every day, it's harmful, no matter how weak"? That's more reasonable than "communications are practically unintelligible." Remember, Part 15 devices seek to share spectrum that is already in use by a primary, licensed service. They should remain very much in the background, and should consider the needs and existing practices of the incumbent.

**4. The sensitivity of the measuring equipment must be standardized.** I'm not sure what they mean by this, but it appears to be a method of disenfranchising the average Amateur Radio operator and shortwave listener, disqualifying them from filing a complaint because they're not using "standardized measuring equipment." Engineers may want to quantify everything for easy analysis, but interference to radio reception from BPL occurs between the ears. The professional test equipment I've seen, with two-foot long antennas attempting to measure weak signals at 14 MHz, doesn't even hear signals that obviously make reception difficult on an average Amateur Radio station.

Amateur Radio operators don't use super-sophisticated receivers unavailable to the average mortal. The radios typically cost less than \$2000 (sometimes much less - Progress Energy has one in Bill Godwin's vehicle that cost under \$900, and it was easy to get). They are good, as receivers go, beating "consumer" electronics in most specifications, but there's nothing magic about the state of this art. We're not asking for a standard of interference useful only to NASA in tracking a Mars probe. This is real-world, everyday reception.

### **PEC/Amperion not meeting their own stated goals for mitigation**

Progress Energy's comments included this statement: *With the Amperion Access BPL system, the*

*RF Signal center frequency signal can be remotely adjusted within the frequency spectrum. Additionally, the bandwidth of this RF signal can be remotely modified both in width and to introduce notches for certain frequency ranges to avoid interference. Therefore, with the Amperion system we have found that system performance can be adjusted remotely to eliminate any real “harmful interference” at a particular site. In general, we feel that Access BPL systems should be able to select which specific frequencies are used for transmission.*

In practice, Amperion has not been able to control their system to the degree suggested. In their trail area at Holland Meadows, south of Raleigh, they attempted to move the signals on an overhead power line off of Amateur Radio frequencies in early April. The result moved signals off the 12 and 10 meter Amateur Radio bands, but put a new signal in the 20 meter band, from 14.290 MHz to the band edge at 14.350 MHz (and continuing on up above that for several MHz, covering several shortwave broadcast bands). We notified PEC of this within a few days of their attempt, and we complained to the FCC after that. As of mid June, the signal was still there, reflecting the company’s inability to tightly control the spectrum used.

The “notches” referred to are effective only if one accepts PEC’s definition of “harmful interference.” My monitoring shows that there are still BPL signals across the entire “notched” 12 and 17 meter bands, and BPL signals continue deep into the 15 and 10 meter bands where the BPL spectrum blocks do not end with a “brick wall,” but instead trail off slowly. The signals are weak in my mobile, but would be audible to a home station within a block. There are no home stations in this area to hear it, but in Cedar Rapids, Iowa, Jim Spencer, W0SR, does live close enough, and Amperion has not been able to notch, move or reduce signal levels to clear up all the ham bands at his home station. His story is documented on the ARRL web site at <http://www.arrl.org/news/stories/2004/06/15/2/?nc=1>, and I’ve talked to him personally. All the resources of Amperion have not been able to handle documented interference in these small trial areas.

### **Should Amateur Radio get clear spectrum?**

Why should Amateur Radio operators get relatively clear spectrum? Doesn’t the public need for broadband outweigh the needs and desires of a relatively few radio enthusiasts?

No, it doesn’t. The Central Park analogy is useful here. Like the radio spectrum, open land in New York city is a scarce, precious resource. Developers and businesses could make good use of the land preserved for Central Park (and for many other city parks, and National Parks, even the remote ones like Yellowstone). But this land is reserved for use directly by the public, and development is not permitted, for once developed, the resource would be lost to the public for all time.

The Amateur Radio bands, a small slice of the total spectrum, are the only serious reserve of radio frequencies open to the public. There are a few other tiny services, such as CB, FRS and MURS, that provide spectrum to the public, but use of them is greatly restricted. Amateur Radio permits experimentation, exploration and a great deal of communication by more or less average citizens. I qualify that by



“more or less” because a license is required, and a licensee must pass an exam demonstrating basic knowledge of radio principles and Morse code to obtain the license. 403,000 people now hold that license, and an additional 300,000 hold a license that does not require Morse code. The transmitter power and frequency control permitted to Amateurs makes the license requirement necessary, but it is available to everyone, citizen or not, without age restriction.

Yes, the radio spectrum is a scarce resource, and the pressure is great. If BPL operators thought they could find a better place to emit their signals, they would go there. They think they can get away with bothering “a few hams and SWLs” and nobody else will care. The value of the service might be high, though that is debatable in the light of other broadband delivery modes available today and expected in the near future that do not interfere with other spectrum users. In any case, they shouldn’t be permitted to change the rules about who uses spectrum, and how.

### Reaction time and mitigation practices

How quickly should a utility react when they receive a complaint of interference from BPL? I’ve asked PEC that question, and received no reply. But there is a strong hint that the answer is “not quickly” on page 6 of their comments, where they state: *any reported harmful interference complaint should be investigated to determine first, whether or not it is related to the Access BPL system, and whether the interference is truly harmful.*

This seems reasonable from the utility’s perspective – they can’t just be shutting down their system on the off chance that the claim of harmful interference is justified. Hundreds of Internet users might be inconvenienced. But wait – this is Part 15 we’re talking about, not a police radio system. Part 15 doesn’t give the unlicensed user the prerogative to sit around and wait until they have time to investigate a complaint. Once again, PEC is asking to invert the priorities. If a service is so critical that it can’t be interrupted, perhaps it shouldn’t be relying on the low priority of Part 15.

I wonder if the Amperion and PEC officials have looked at the bottom of their cordless phones for the statement regarding Part 15? It’s hard to read, but I’ve included a picture from the bottom of my phone for everyone’s benefit. Do they realize they can’t ask for any more protection than is



accorded this simple phone? If my phone began causing interference, say to my neighbor's satellite TV reception, do you suppose he'd be happy to wait while I send out my investigator, when I got around to it?

Yes, the BPL operator runs some risk that an interference complaint is in error (see the next section). I repeat, this is Part 15. It's a risky proposition to be there! If you don't like the risk, operate as a licensed, protected system.

### **Database requirement, interference source identification**

The FCC asked for comments on a public database of BPL locations and frequencies. Progress Energy and other BPL operators opposed them. PEC made this comment: *We are not aware of any other requirements to publish information about other unlicensed radiation sources that conform to FCC Part 15 Rules. Why should BPL be any different?*

The answer is that no other Part 15 system operates at anywhere near this scale, both in spectrum occupied and territory covered. None has the potential to cause interference on the scale of BPL. So more elaborate methods of identifying and solving the problem are warranted. I support the database concept, and I've recommended a beacon.

Even among the Amateur Radio population, people who are generally more technically competent than the average public, I see difficulty with identifying BPL. I've fielded many questions from hams who wonder if they are receiving BPL, when there is little chance of the interference they are hearing actually being BPL. When BPL is widely deployed and the chance of interference is much greater, the questions will be frequent.

I know of no foolproof way to allow anyone of a low technical competence level to identify a BPL signal. It takes skill to identify interference by its signature. It takes specific understanding to find a beacon on a spot frequency that identifies a broadband signal. And it would take both to locate information in a public database.

I'll give up on the uninformed public being able to identify the signal and trace its source to a utility, and assume that serious problems will fall to people who know something about RF, and hopefully about BPL. They could make use of a database and beacon to identify the signal.

In my comments, I stated that the beacon should be "least common denominator" AM. I still think that's a good idea. The beacon could point the way to the database. This will eliminate a lot of "false positives" in reporting BPL interference.

### **FCC/PEC failure to respond to complaints**

I have filed four separate complaints with Progress Energy, copied to the FCC, based on observations I've made in their trial area near Raleigh, NC (see the Appendix for the text of my complaints). Each was based on a change that I observed that impacted Amateur Radio and shortwave broadcast frequencies. I have not to this date received a formal reply from either the FCC or PEC, although I was

copied on an e-mail to the FCC from Progress Energy's attorney for Regulatory Affairs Len Anthony, in which he claimed that PEC made changes such that their system "is not causing any harmful interference and is in full compliance with the FCC's Part 15 rules." (See Appendix C for the full e-mail.) That e-mail was in error, as the PEC Trial was now radiating on the top of the 20-meter Amateur band, and the inadequate notches were in effect on the 12 and 17-meter bands.

I can understand the need for some patience as bugs are worked out of new technology, but we are now talking a time frame of months since we pointed out that the changes PEC made failed to clear the 20-meter ham band, and the notched signals were still audible. Part 15 is clear – a radiator causing harmful interference to a licensed service must be fixed or turned off. PEC claims the interference they continue to emit is not harmful. We claim it is. The FCC has failed to make a timely determination on the nature of the interference, and it continues unabated since the only substantial change was made in late March, 2004.

## **Conclusion**

Although no one is admitting it, BPL vendors and operators are asking for a substantial change in the nature of Part 15 operation. The rules may not have been drawn clearly enough to proscribe this operation, as it was never expected. The vendors and operators are paying lip service to the rules regarding interference now, and following a vocal reaction from the licensed, incumbent service, they are taking action to reduce the effects of their radiation. But at the same time they are claiming that a high level of interference must be tolerated by the licensed service. They resist policy that would put the burden on them to quickly resolve interference complaints.

But most egregious is the nature of BPL in Part 15: a widespread communications service that potentially millions of customers will come to depend on for what will sometimes be critical operations (but, like Amateur Radio, will mostly be used for routine communications and entertainment value). It's not hard to foretell that a case will soon be made that this service requires more protection than that accorded by Part 15. Even without that claim, the BPL operators expect incumbent, licensed, primary service operators to jump through hoops when they experience interference.

The shoe is on the wrong foot.

Gary Pearce KN4AQ  
116 Waterfall Ct.  
Cary, NC 27513



# **Appendix A**

## **KN4AQ's first complaint to the FCC and Progress Energy**

Len Anthony, Progress Energy Regulatory Affairs

cc:

Bill Godwin, Progress Energy

Anh Wride, FCC

James R. Burtle, FCC

Riley Hollingsworth, FCC (FYI)

Ed Hare, ARRL

Frank A. Lynch, ARRL

Saturday, March 13, 2004

This e-mail letter is a formal complaint of interference received from several Broadband over Power Line (BPL) installations operated by Progress Energy in the Wake County, North Carolina area.

I am:

Gary Pearce KN4AQ  
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919-380-9944  
kn4aq@arrl.net

I encountered all of this interference while mobile, or visiting the stations of other amateur radio operators. I do not hear any BPL interference at my home in Cary at this time.

November 16, 2003. I first encountered BPL interference on this date, near the Wakefield subdivision in north Raleigh, along Falls of the Neuse Road near Wakefield Pines Rd. The interference appeared as a series of closely spaced RF carriers, approximately 1 kHz apart, covering the lower half of the 10 meter amateur radio band, from 28 to near 29 MHz (and some spectrum below that band, including the 40 CB radio channels near 27 MHz). Some of the carriers had a little "tik-tik-tik" sound at about a 2 Hz rate. The interference was strong - S-9 - for about a half mile along Falls of the Neuse Road, and obliterated several amateur radio signals that I was monitoring.

I understand this was the Phase I trial area, and the test has been discontinued.

January 15, 2004. On this and several subsequent dates, I received interference while driving along Holland Church road between 1010 Road and Pagan Rd. in southern Wake County, specifically in the vicinity of Feldman Dr. The signature of the interference was the same: closely spaced carriers, about 1 kHz apart, some with a tik-tik-tik modulation, and occasionally a longer burst of what sounded like data. The interference covered two blocks of spectrum, from 23.44 - 26.08 MHz (including the amateur radio 12 meter band) and 27.9 - 31.7 MHz, (including the amateur radio 10 meter band). The interference was strong - S-9 - for about a half mile along Holland Church road, and audible in places along Pagan Rd. It obliterated several amateur radio signals that I was monitoring as I drove through the area.

I also received interference with the same signature in several spots along Feldman Dr., in various other segments of the high-frequency spectrum - near 11 and 15 MHz in particular. The signals were weaker, but plainly audible. One caused a "beat note" against the 15 MHz WWV time and frequency reference signal.

I have subsequently been through this area several times, and the interference is still present. My last visit was on February 28th.

February 20, 2004. On this and several subsequent dates, I received interference while driving along NC Highway 55 and James Slaughter Rd, just north of the town of Fuquay-Varina. The interference was strongest along James Slaughter Road, opposite the Woodchase subdivision. Again, the signature of the interference was RF carriers, about 1 kHz apart, with a bit of digital modulation now and then, including the tik-tik-tik at about a 2 Hz rate.

This interference was across 21.9-25.7 MHz (including the amateur radio 12 meter band) and 27.5-30.0 MHz (including the amateur radio 10 meter band). The interference was S-9 along James Slaughter Road, and S-5 in the Food Lion parking lot at NC-55, and obliterated several amateur radio signals that I was monitoring.

In the Woodchase subdivision, I also heard the "BPL signature" signals on several other points in the high frequency spectrum. The signals were weaker, but plainly audible. I also heard signals in the 7 and 24.5 MHz area about a mile further north on James Slaughter Road, near the Whitehurst subdivision. These signals were S-6 to S-9 for about 1/4 mile along James Slaughter Road.

I most recently heard this interference on March 5th, 2004.

Finally, on February 28, 2004, I personally visited the homes of three amateur radio operators who live in the vicinity of the Progress Energy Phase II BPL trials, and observed interference as received at their stations as follows:

Mike Payne KM4UT  
Raleigh, NC

Mike lives .7 miles south of the trial site on Holland Church Road. He is using a dipole antenna at about 30 feet. I observed that he was receiving a clear but weak BPL "signature" in the top half of the 10 meter band, above 28.8 MHz, and many smaller clusters of individual carriers in the band below that.

Ted Root N1UJ  
Fuquay-Varina, NC

Ted is about a half mile southwest of the James Slaughter Road site. He is also using a dipole antenna at about 40 feet. He was receiving weak but clear BPL signature signals across the 25 and 28 MHz areas.

Roland Erickson WA0AFW  
Fuquay-Varina, NC

Roland is about a half mile south of the James Slaughter Rd. site. He is using a dipole antenna in the attic of a retirement village building. He has a very high ambient noise level (S-6) across the 25 and 28 MHz bands, but was receiving the BPL signature signals clearly above that noise level across those bands.

You might ask if my complaint of interference while mobile, some distance from my home, is justified. I contend that it is, for several reasons.

First, amateur radio is a very "mobile" service. Tens of thousands of amateur radio operators have and use high frequency mobile equipment, and we can be found anywhere, using all hf bands, at completely unpredictable times.

Second, the Progress Energy Phase II trials are in very limited area tests. There are no amateur radio operators living inside the neighborhoods being served, though there are several within interference range - about a mile. We are justified in traveling to the sites with normal amateur radio equipment, operated in a normal manner,

to observe and complain about interference we receive. This observation must be extrapolated to a wider geographic area to anticipate the kind of interference that would be received if BPL were to be widely deployed, especially in denser suburban and urban neighborhoods.

You might also ask if weak BPL signals constitute harmful interference. I contend that they do. Amateur radio operation is unlike most other radio operation, in that amateurs tune across their band segments looking for signals. Often we are looking for weak signals from distant parts of the world. Our predominant modes are single sideband and cw. In those modes, a series of carriers 1 kHz apart presents a most irritating series of "beat notes" - tones that vary in pitch as the spectrum is tuned. At 1 kHz spacing, they are continuously present in a receiver using customary bandwidth filters. And even weak BPL signals can make weak amateur radio signals difficult or impossible to receive.

The presence of any BPL signal of any strength at either a home or mobile station at any location is an unwarranted incursion in the amateur radio bands, and is also a problem for anyone tuning shortwave broadcast or other radio services.

Thanks for your consideration. I look forward to hearing the results of the investigation into my complaints.

Sincerely,

Gary Pearce KN4AQ

# **Appendix B**

## **KN4AQ's second complaint to the FCC and Progress Energy**

To: Len Anthony, Progress Energy Regulatory Affairs

From: Gary Pearce KN4AQ  
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cc:  
Bill Godwin, Progress Energy  
Anh Wride, FCC  
James R. Burtle, FCC  
Riley Hollingsworth, FCC (FYI)  
Ed Hare, ARRL  
Frank A. Lynch, ARRL

Monday, March 29, 2004

This e-mail letter is a second formal complaint of interference received from several Broadband over Power Line (BPL) installations operated by Progress Energy in the Wake County, North Carolina area. This complaint covers interference on NEW frequencies that was not present in my first complaint filed on March 13th.

In my March 13th complaint I detailed interference that I observed while operating my mobile amateur radio equipment in the vicinity of the Progress Energy Phase II BPL trial areas in southern Wake County, North Carolina. No one from either Progress Energy or the FCC has contacted me as a result of that complaint (except a request from the FCC to drop David Solomon from the recipient list, which I have done). I have seen Bill Godwin in a somewhat chance encounter at the Holland Church site, and we had a good discussion on the state of the trial.

I have observed that Progress Energy has changed the spectrum used for the overhead line segments in both trial areas. If I'm correctly assuming that this was done to respond to complaints, and demonstrate frequency agility and the ability to mitigate interference by avoiding amateur radio spectrum, the attempt is appreciated, but it was not completely successful. New amateur radio and shortwave spectrum is now receiving interference, and that is the basis of this complaint.

On March 20, 2004, in the Woodchase subdivision area near Fuquay-Varina, where BPL signals had covered the 12 and 10 meter bands, I observed clear, strong BPL signature signals from 21.5 to 24.90 MHz, and 25.49 to 28.0 MHz. This almost cleared amateur radio spectrum, but not quite.

The lower segment, from 21.50 to 24.90 MHz, encroached clearly on the bottom 10 kHz of the 12 meter band, from 24.89 to 24.90 MHz, and what I'll call "residual" BPL carriers - carriers at the edge of the main spectrum that trail off in amplitude over the course of 10 to 20 kHz - encroached further. The residual carriers present a correspondingly decreasing problem of interference, but when the bulk of the BPL carriers are strong, the residual carriers can also interfere with weak amateur radio signals.

Note that if a BPL operator is attempting to place a BPL block adjacent to the bottom of an amateur band, they should be aware that these residual carriers will fall across an area of extreme interest where amateurs use Morse code to communicate with distant, often very weak, amateurs in remote parts of the globe. Additional care should be taken to avoid letting this "residual" interference cross the bottom few kHz of any amateur band.

The higher segment, from 25.49 to 28.0 MHz, also left some residual carriers encroaching on the bottom of the 10 meter band at 28 MHz. The main carriers did cover all 40 CB channels and interfered with signals I monitored there.

Then I drove through the Holland Church Road trial site and observed no change since my March 13th complaint - the BPL signals still covered the 12 and 10 meter ham bands and adjacent spectrum.

On March 23, 2004, I returned to the Holland Church Road trial area. That's when I ran into Bill Godwin and two other Progress Energy engineers, observing and reporting on some difficulty that Ameripion was having moving the spectrum on the overhead line. The signals were gone from the 12 and 10 meter bands, and appeared erratically elsewhere. Since this was an effort in progress, I didn't worry about the signals I received.

On March 28, 2004, I returned to the Holland Church site again. This time I monitored signals on the following spectrum blocks:

14.29 - 16.805 MHz

17.33 - 21.00 MHz

24.53 - 28.00 MHz (with 12 meter notch?)

Reception was somewhat difficult because of a high general noise level (what we usually refer to as "power line noise," ironically in this case. The true source of this particular noise is unknown). The BPL signature signals were generally strong and clear above this noise.

After observing what appeared to be an attempt to completely avoid amateur radio spectrum at the Woodchase trial area, I was disappointed to see that two busy amateur radio bands were partially or fully covered here: 20 and 17 meters. The BPL carriers interfered with many signals as I tuned from 14.29 to the band-edge of 14.35 MHz in the 20 meter band. Strong signals were audible, but BPL carriers placed a loud "beat note" behind them, making reception irritating at best. Weaker signals were rendered unreadable.

I had the same situation across the entire 17 meter band, from 18.068 to 18.168 MHz. Weaker signals were impossible to receive, while stronger ones were accompanied by a loud heterodyne whistle.

I also tried listening to some shortwave broadcast signals in the spectrum immediately above the 20 meter ham band. Switching to AM reception with a 6 kHz band pass filter, I noticed that the BPL signals were a continuous "blanket" across the spectrum. Since the BPL carriers were 1.1 kHz apart, I heard the expected 1.1 kHz heterodyne tone as part of that interference blanket.

The 15 MHz signal from WWV was completely inaudible. Stronger shortwave signals were audible with varying degrees of interference. Weaker signals on 15.160, 15.205, 15.300, and 15.350 MHz were detectable but not readable. This was just a brief sample of the many shortwave signals that received interference from the BPL energy.

I could not observe any "residual" carriers spilling into the 15 meter ham band as the "power line noise" made it difficult to hear the weakest BPL carriers. With some difficulty I observed what appeared to be a notch in the 24.53 - 28.0 MHz block. The carriers were at least attenuated in the 24.89 - 24.99 MHz area (the 12 meter ham band), but I thought I could hear some weaker carriers through the "power line noise".

That is my report. I'll repeat my contention from my first complaint that interference reports from mobile stations are warranted because:

- amateur radio is a very mobile radio service,



- these are very limited trial areas, and the experience and results must be extrapolated to predict the effect BPL will have if widely deployed in densely populated areas.

I'll conclude with an example of truly random interference caused by BPL to a mobile ham who was not part of, or recruited by, our investigation team:

Over the past few weeks I've had an e-mail exchange with Andy Stoy K4MTN, from Wake Forest, NC. Initially, Andy's e-mail sounded like many that Tom Brown N4TAB, Frank Lynch W4FAL and I have received from area hams who suspect that they are hearing BPL interference from areas where none is known to exist. Andy said he had been hearing loud interference - he called it "static" - for months along a half-mile stretch of Falls of the Neuse Road near the Woodfield subdivision. He was describing the Phase I trial area which we believed to have been disconnected, and his description of "static" didn't sound like the BPL signature we're used to.

I pressed him for more specific details, and he finally described the exact location, and the signature sound (closer-spaced carriers with a clicking sound) of Amperion's BPL. Tom Brown traveled to the site and confirmed that the Phase I equipment was still operating on the overhead line along Falls of the Neuse Rd. Andy traveled that route daily, and regularly operates on the 10 meter band. He had been receiving interference and loss of communications on that stretch of road since at least last fall, but didn't know what caused the problem until we began publicizing the trials. Then he contacted us. He will be filing his own report of interference.

Andy's story may seem isolated, a rare, chance occurrence. It is significant for several reasons. One is that it happened at all, since there is a total of less than two miles of BPL coverage along Wake County highways. Another is that hams don't know what BPL is yet. We've reached a few with our message, but many more have never heard of it. So there may be a few more Andy Stoy's out there who have passed through the existing trials areas, received interference, and didn't know what it was or who to call.

I appreciate the fact that Progress Energy and Amperion are responding to our reports and complaints of interference. I'd prefer to just call them "reports," but public proclamations that "there have been no interference complaints" have pushed us to this formal posture. My goal is to make you (Progress Energy and the FCC) aware of the real conditions for radio amateurs and other HF spectrum users in the trial area so that you can anticipate the level of difficulty you can expect in a broader implementation.

I'd expect that Progress Energy and Amperion could completely avoid amateur radio spectrum in the overhead segments of this limited trial area. I'm surprised that after the first complaints, you moved to occupy different amateur radio spectrum. But even if you had completely missed ham bands in this first move, success in this limited arena is not a good predictor of the ability to mitigate interference in a full system, where you will be constrained to use more spectrum and not re-use spectrum for several line segments. And the question of interference from the underground line segments has not been addressed at all.

Sincerely,

Gary Pearce KN4AQ

# Appendix C

## Progress Energy reply to the FCC

From: Anthony, Len  
To: James Burtle (FCC), KN4AQ, N4TAB, W4FAL  
Cc: Oja, Matt, Godwin, Bill  
Subject: Progress Energy Carolinas BPL Trial  
Date: Tue, 20 Apr 2004

PEC has met with representatives of the ham radio operators in the Raleigh area. Joint measurements of the impact of PEC's BPL system on ham radio transmissions in and around the two subdivisions where BPL service is offered were taken. These measurements occurred subsequent to PEC modifying its BPL system to minimize interference with ham radio transmissions. These tests revealed a small level of interference at the fringes of certain frequencies. Since that time, further modifications have been made to address this fringe interference. It is PEC's position and interpretation of the FCC's rules with regard to "harmful interference" that any interference that may still exist is not "harmful" as that term is defined by the FCC's rules. This level of interference does not seriously degrade ham radio operation or transmissions or cause repeated interruptions. Importantly, since PEC can make modifications to completely eliminate any interference with fixed ham operators, the!

only impact of any kind upon ham operations is upon mobile operators. Given that any interference experienced by a mobile operator only occurs within close proximity to the BPL facilities, such interference would be very short lived. Thus, PEC is not causing any harmful interference and is in full compliance with the FCC's Part 15 rules.

# **Appendix D**

## **KN4AQ's third complaint to the FCC and Progress Energy**

To: Len Anthony, Progress Energy Regulatory Affairs

From: Gary Pearce KN4AQ  
116 Waterfall Ct.  
Cary, NC 27513  
919-380-9944  
kn4aq@arrl.net

cc:  
Bill Godwin, Progress Energy  
Anh Wride, FCC  
James R. Burtle, FCC  
Riley Hollingsworth, FCC (FYI)  
Ed Hare, ARRL  
Frank A. Lynch, ARRL

Thursday, May 12, 2004

This e-mail letter is my third formal complaint of interference received from several Broadband over Power Line (BPL) installations operated by Progress Energy in the Wake County, North Carolina area. This complaint covers the continuation of interference noted in my second complaint, filed March 29, 2004. This interference has not been addressed as of May 4<sup>th</sup>, 2004, notwithstanding the claim in your April 20<sup>th</sup> e-mail to James Burtle that, "Since that time, further modifications have been made to address this fringe interference." (My complaints #1 and #2 are included at the end of this e-mail, for convenient reference.)

Before detailing the interference I monitored on May 4<sup>th</sup>, I must address the question of "what is harmful interference" in general, and the question of harmful interference to *mobile* operation, which you dismissed in your April 20<sup>th</sup> e-mail.

First, the question of harmful interference. Amateur radio operators frequently operate at the margins of signal strength and quality. Signal strengths so weak that other services would consider them unusable are used routinely for amateur radio communication. We also tune across spectrum that contains no signals at all, looking for stations to contact. In our receivers, in the single sideband (voice) mode, your continuous series of BPL carriers appear as an always-present series of audio tones. The pitch of the tones depends on the exact frequency tuned, but there is always a tone somewhere in the prime spectrum for communications-quality audio, between 500 and 2500 Hz. This "seriously degrades" our radio communications service whether desired signals are being completely obscured or not.

Yes, this means that interference just above the ambient noise level at any given amateur radio station is harmful, as it changes the routine nature of operation that we have enjoyed since shortly after the dawn of radio. You are attempting to overlay a second, unlicensed radio service atop the spectrum allocated to a licensed service using Part 15 Rules that were never intended to apply to signals of this combination of coverage and duration. We will have no complaint if there is truly no interference, if that can be accomplished. The technology you have deployed today does not come close to meeting that goal.

Second, mobile operation is a perfectly valid form of amateur radio communication, and interference to it is no more acceptable than interference to fixed operation. The ability to drive away from interference may be an option for a mobile operator, but that does not remove the Part 15 liability of the operator of an unlicensed device to avoid harmful interference, for several reasons. The mobile operator may drive in and out of multiple interference zones as he or she travels down the road. The mobile operator may be in heavy traffic, or may be stopped by a traffic light, and what would be a minute of interference at 35 mph could extend to several minutes. And the mobile operator may stop in a driveway or parking lot for an extended period inside an interference zone. With no practical way to immediately mitigate this interference, the mobile operation will be seriously degraded.

In addition, keep in mind that you are operating small trials in neighborhoods where there are no amateur radio operators. In these neighborhoods, we use mobiles as surrogates for fixed stations. In this role, the mobiles have a serious handicap. Their inefficient antennas do not permit reception of BPL signals at anywhere near the distances that even simple dipole antennas at fixed stations do. To be specific, when driving away, perpendicular to the active overhead power line, the BPL signal fades to inaudible in 400 to 500 feet (not, by the way, the 90 feet Progress Energy suggested in comments on the Docket 04-37 NPRM). However, home stations, using dipole antennas, can hear the signals well as much as a mile away. Danny Hampton K4ITL lives on Rock Service Station Road, just north of Pagan Road, eight-tenths of a mile from the extractor on Holland Church Road near Feldman Road. In our January 15<sup>th</sup> observation (and many times since), he was able to hear the signal on that overhead line using a dipole antenna.

So to summarize these points, weak signals can and do create harmful interference, mobile stations are fully legitimate targets for harmful interference, and we are using mobiles to provide observations that would otherwise be available if there were any hams living in the trial areas.

Now, on to my May 4<sup>th</sup> observations.

On May 4<sup>th</sup>, I positioned my mobile amateur radio station at the intersection of Holland Church Road and Elsie Lorraine Road, at the entrance to the Holland Meadows subdivision. This is near the power line used for BPL feeding the neighborhood.

I received signals with the Amperion “BPL signature” (mostly unmodulated carriers, 1.1 kHz apart, covering a large, continuous block of spectrum) from 14.195 to 21.45 MHz, including all or parts of the 20, 17 and 15-meter amateur bands. Within those overall limits, the BPL signal was strong on most frequencies, but there were some frequencies where the signal was fairly weak.

The signals from 14.195 to 14.290 were weak, but plainly audible above the ambient noise level. These are some of the “fringe” signals you refer to in your April 20<sup>th</sup> e-mail. I monitored several amateur radio transmissions in this spectrum, and while the signals did not obliterate any, they did present an annoying, continuous tone behind all of them on my single-sideband receiver.

The signals from 14.290 to 14.350, covering the top 60 kHz of the 20-meter amateur radio band, were “full strength,” reaching “S-7” on my Icom 706 MKIIG transceiver and Outbacker Perth Plus antenna while on the highway adjacent to the power line. This is the same signal block I noted in my March 29, 2004 complaint. I have observed that signal block on April 6<sup>th</sup> (a demonstration with Bill Godwin), April 13<sup>th</sup>, April 21<sup>st</sup>, and April 29<sup>th</sup>, in addition to May 4<sup>th</sup>. It has not changed. It continues to be strong enough to make reception of weak and moderately strong amateur radio signals impossible.

The BPL signals continue full-strength through the 15.10-15.80 MHz and 17.50-17.90 MHz shortwave broadcast bands, and covered up some of the weaker stations while putting an annoying, continuous whistle (heterodyne) against some stronger signals.

The BPL signal does dip to just above the noise level in the 16.80 - 17.34 area. I believe this is the crossover area between downlink and uplink signals on this leg of power line.

The signal is also weaker from 18.075 - 18.185. This is the notch for the 17-meter amateur radio band. However, the signal is full strength in the bottom 7 kHz of the band, from 18.068, to 18.075. And the BPL signal continues to be clearly readable, though weak, throughout the band. In other words, the notch depth is not great enough to remove the signal completely when it is “S-7” outside the notch. It remains strong enough to obscure a weak ham signal, and presents a continuous, annoying heterodyne behind stronger signals. It also presents the usual, continuous series of carriers when tuning across unused frequencies while looking for stations to contact.

I estimate that a home station would get an audible signal as far as two blocks away. A ham on a lot within a half block of the line would get a fairly strong signal. And this is the configuration I assume you would plan for the power lines in every neighborhood.

Inside the Holland Meadows neighborhood, where BPL is carried on underground power lines, the signals are weaker than those on the overhead lines. But they are still plainly audible – and often much stronger than the “fringe” and “notched” signals on the overhead lines – in the vicinity of the above-ground pedestals. At 1141 Feldman, I received signals from 2.5 MHz to 5.0 MHz, and from 5.95 MHz to about 9.7 MHz. This put full-strength signals across the 80 and 40-meter ham bands. I estimate that a home station would be able to hear these signals for a block or two as well. At 5528 Holland Church Rd, I received signals from a pedestal from about 6.35 to above 8.3 MHz, including full strength signals across the entire 40-meter band.

At the Woodchase neighborhood, in Fuquay-Varina, I parked along James Slaughter Road, just south of the entrance to the subdivision, on the west side of the road. The total spectrum in use here ran from 21.20 to 28.1 MHz, with a notch for the 12-meter ham band, and a crossover around 25 MHz.

From 21.2 to 21.47 MHz, the signal slowly ramps up in amplitude, with plainly audible signals in the 15-meter band from 21.35 to 21.45 MHz. At 21.47 MHz it jumps to full strength, interfering with a few



shortwave broadcast signals in the 21.45 –21.75 MHz range. The BPL signals fall off below the bottom of the 12-meter band, at 24.86, and remain weak to 25.20, where they became inaudible. Once again, the BPL signals were weak but audible throughout the entire 12-meter band. They fall off just below the 10-meter band at 28.0 MHz, but weak signals remain audible for another 100 kHz inside the ham band.

It would appear from the fact that the top 60 kHz of the 20-meter band and the bottom 7 kHz of the 17-meter band still have full-strength BPL carriers in them that this hardware is not that easy to control. The “fringe” carriers, and the signals remaining in the notched segments, suggest that it can’t be just turned on and off where you want, at will, or controlled to the level that you (and we) might desire.

Progress Energy has obviously paid attention to our complaints, and taken steps to correct the problems that we’ve pointed out. Those steps have fallen short, both by leaving full-strength signals on parts of two Amateur Radio bands, and by leaving weak “fringe” or notched signals on other bands. Rather than dispute our claims, I suggest you take our information to your vendor and ask why they can’t make the hardware perform to the level claimed.

We disagree on the definition of “harmful interference” – a critical point on which the FCC or a court will make the final determination. I can assure you that the Amateur Radio and shortwave listening communities will work hard to protect continued access to the radio spectrum without the ever present beat of a BPL signal in either the foreground or background of our receivers.

Sincerely,

Gary Pearce KN4AQ

# **Appendix E**

## **KN4AQ's fourth complaint to the FCC and Progress Energy**

To:

James Burtle, FCC

Len Anthony, Progress Energy Regulatory Affairs

From: Gary Pearce KN4AQ

116 Waterfall Ct.

Cary, NC 27513

919-380-9944

kn4aq@arrl.net

cc:

Bill Godwin, Progress Energy

Anh Wride, FCC

Ed Hare, ARRL

Frank A. Lynch, ARRL

Thursday, May 21, 2004

This e-mail letter is an update of my third formal complaint of interference received from several Broadband over Power Line (BPL) installations operated by Progress Energy in the Wake County, North Carolina area, submitted on May 12, 2004. I'm updating it to directly address Mr. Burtle of the FCC, in case there was any confusion that I requested FCC action and a reply on the complaint, and to add that my May 4 observations were confirmed by a subsequent observation on May 19, 2004.

(The remainder of this complaint is the same as the text of the third complaint, in Appendix D, and is not repeated here. As of June 22, 2004, I have not received a reply from either PEC or theFCC.)